Summary Report for Individual Task
052-247-2106
Calculate the Weight of a Load for Rubble Removal
Status: Approved

Condition: You are a member of an Urban Search & Rescue (US&R) team given a structural collapse incident with rubble, tape measure and calculator. This task should not be trained in MOPP 4.

Standard: Calculate the weight of objects to be lifted during a structural collapse incident in accordance with (IAW) Federal Emergency Management Agency's (FEMA) Field Operating Guide (FOG).

Special Condition: None

Safety Risk: Low

MOPP 4: Never

Task Statements

Cue: None

DANGER
None

WARNING
None

CAUTION
None

Remarks: All required references and technical manuals will be provided by the local US&R Command.

Notes:

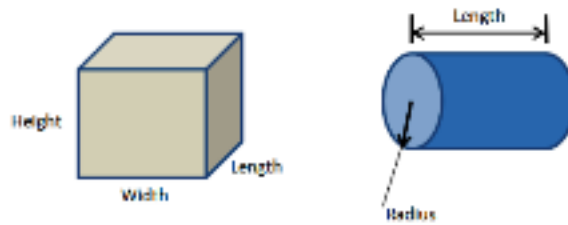## Unit Weights of Common Building Materials

Reinforced Concrete = 150 pcf

Masonry = 125 pcf

Steel = 500 pcf

Earth = 100 pcf

Wood = 40 pcf

pcf – Pounds per Cubic Foot

Calculate Volume

Square or Rectangle - Length x Width x Height = **LWH**

Cylinder - pi x radius² x Length = **πr²L**

Weights of Common Building Materials
Figure 052-247-2106-1

Performance Steps
1. Calculate the weight of a square or rectangular concrete object.
   Note: Length x Width x Height x Unit Weight (from Figure 1) = Object Weight

Square or Rectangular Concrete Slab

L x W x H x Unit Weight (from Figure 1) = Object Weight

L = 20
W = 4
H = 2
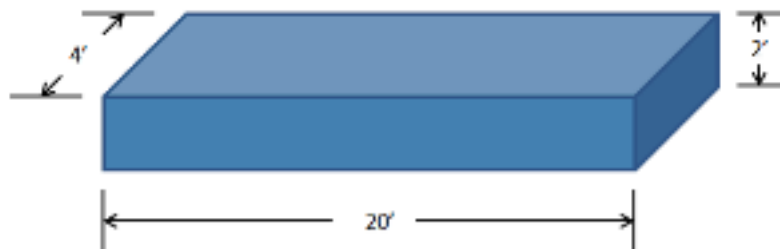Unit Weight = 150 pcf
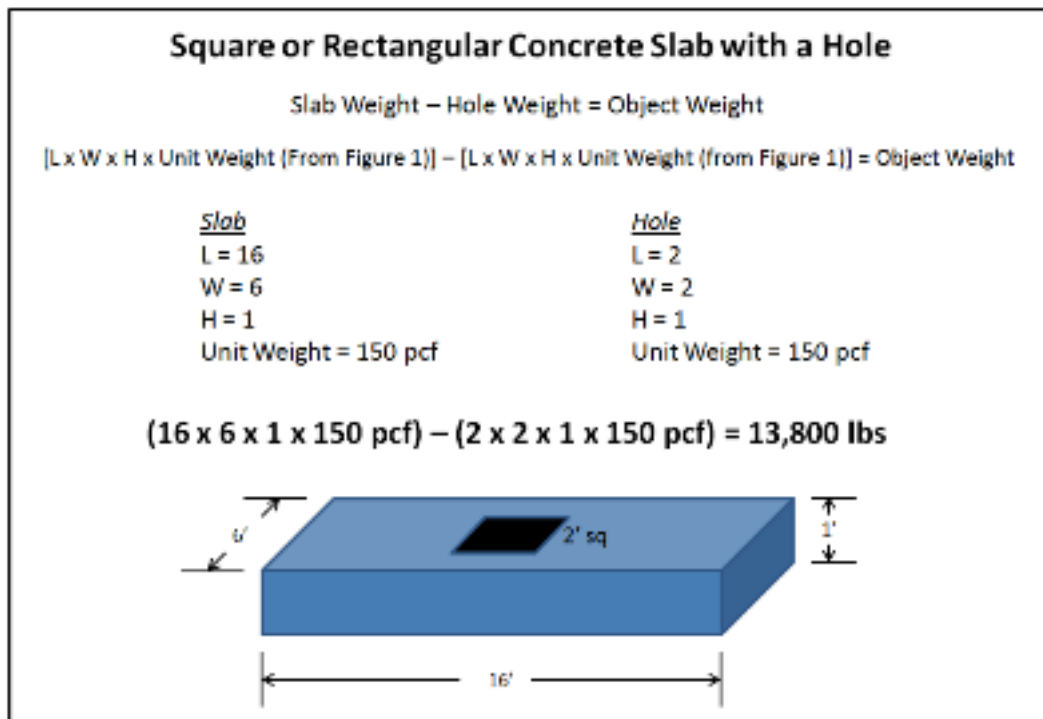
20 x 4 x 2 x 150 pcf = 24000 lbs

Square or Rectangular Concrete Slab
Figure 052-247-2106-2

2. Calculate the weight of a square or rectangular concrete object with a hole.

Note: Slab Weight - Hole Weight = Object Weight

Length x Width x Height x Unit Weight (from Figure 1) - Length x Width x Height x Unit Weight (from Figure 1) = Object Weight

Square or Rectangular Concrete Slab with a Hole

Slab Weight – Hole Weight = Object Weight

[L x W x H x Unit Weight (From Figure 1)] – [L x W x H x Unit Weight (from Figure 1)] = Object Weight

Slab
L = 16
W = 6
H = 1
Unit Weight = 150 pcf

Hole
L = 2
W = 2
H = 1
Unit Weight = 150 pcf

(16 x 6 x 1 x 150 pcf) – (2 x 2 x 1 x 150 pcf) = 13,800 lbs

6'

2' sq

1'

16'

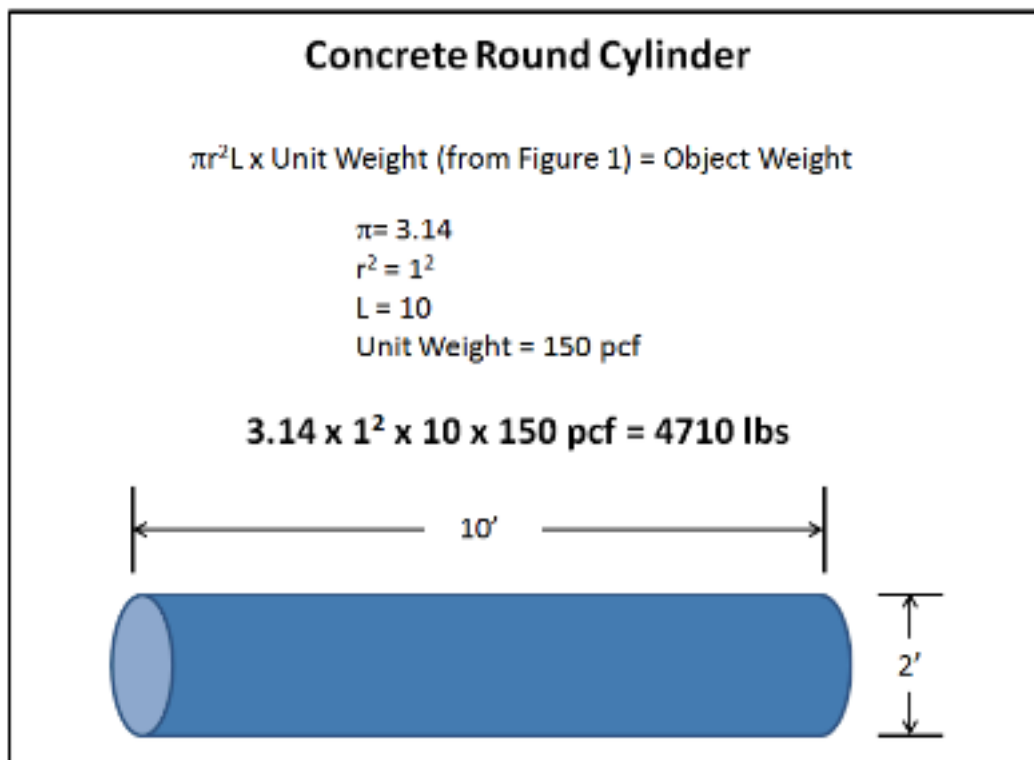Square or Rectangular Concrete Slab with a Hole
Figure 052-247-2106-3

3. Calculate the weight of a solid concrete cylinder.
    Note: Pi x Radius² x Length x Unit Weight (from Figure 1) = Object Weight

Concrete Round Cylinder

$\pi r^2 L$ x Unit Weight (from Figure 1) = Object Weight

$\pi = 3.14$
$r^2 = 1^2$
$L = 10$
Unit Weight = 150 pcf

$3.14 \times 1^2 \times 10 \times 150$ pcf = 4710 lbs

10'

2'

4. Calculate the weight of a round hollow concrete pipe.

    Note: Cylinder Weight - Hole Weight = Object Weight

[Pi x Radius² x Length x Unit Weight (from Figure 1)] - [Pi x Radius² x Length x Unit Weight (from Figure 1)] = Object Weight

Round Hollow Concrete Pipe

Cylinder Weight – Hole Weight = Object Weight

[$\pi r^2 L$ x Unit Weight (from Figure 1)] – [$\pi r^2 L$ x Unit Weight (from Figure 1)] = Object Weight

Cylinder	Hole
$\pi = 3.14$	$\pi = 3.14$
$r^2 = 2^2$	$r^2 = 1.5^2$
$L = 20$	$L = 20$
Unit Weight = 150 pcf	Unit Weight = 150 pcf

$$(3.14 \times 2^2 \times 20 \times 150 \text{ pcf}) - (3.14 \times 1.5^2 \times 20 \times 150 \text{ pcf}) = 16,485 \text{ lbs}$$

20'

3'

4'
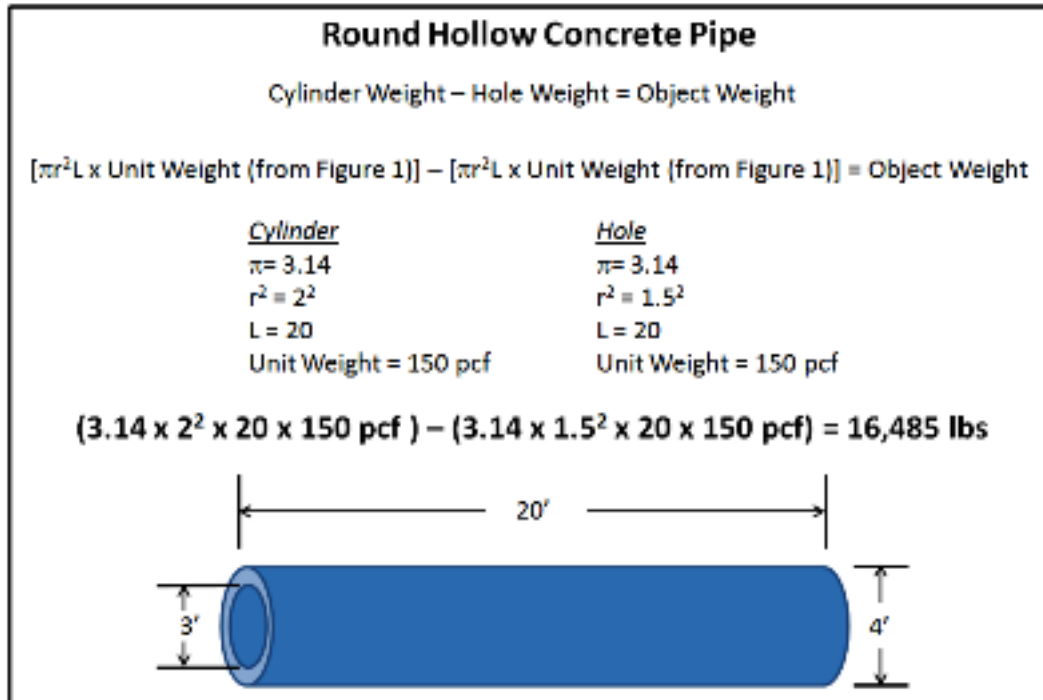
Round Hollow Concrete Pipe
Figure 052-247-2106-5

5. Calculate the weight of a steel plate.

    Note: Length x Width x Height x Unit Weight (from Figure 1) = Object Weight

Must convert inches to feet

Steel Plate
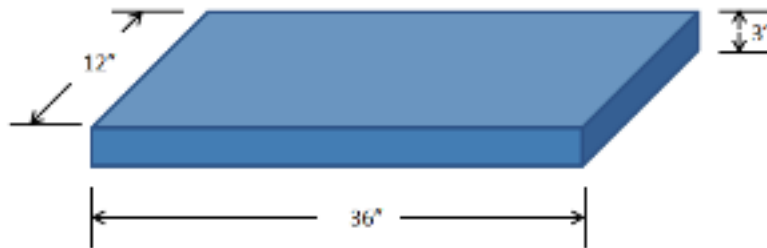
L x W x H x 500 pcf (from Figure 1) = Object Weight

L = 3 (36"÷ 12")
W = 1 (12" ÷ 12")
H = .25 (3" ÷ 12")
Unit Weight = 500 pcf

3 x 1 x .25 x 500 pcf = 375 lbs

Steel Plate
Figure 052-247-2106-6

6. Calculate the weight of a round steel bar.
    Note: Pi x Radius² x Length x Unit Weight (from Figure 1) = Object Weight

** Must convert inches to feet**

Round Steel Bar
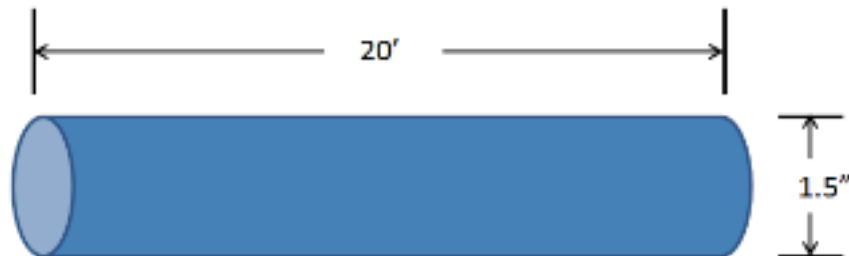
πr²L x Unit Weight (from Figure 1) = Object Weight

π= 3.14
r^2 = .0625² (.75 ÷ 12")
L = 20
Unit Weight = 500 pcf

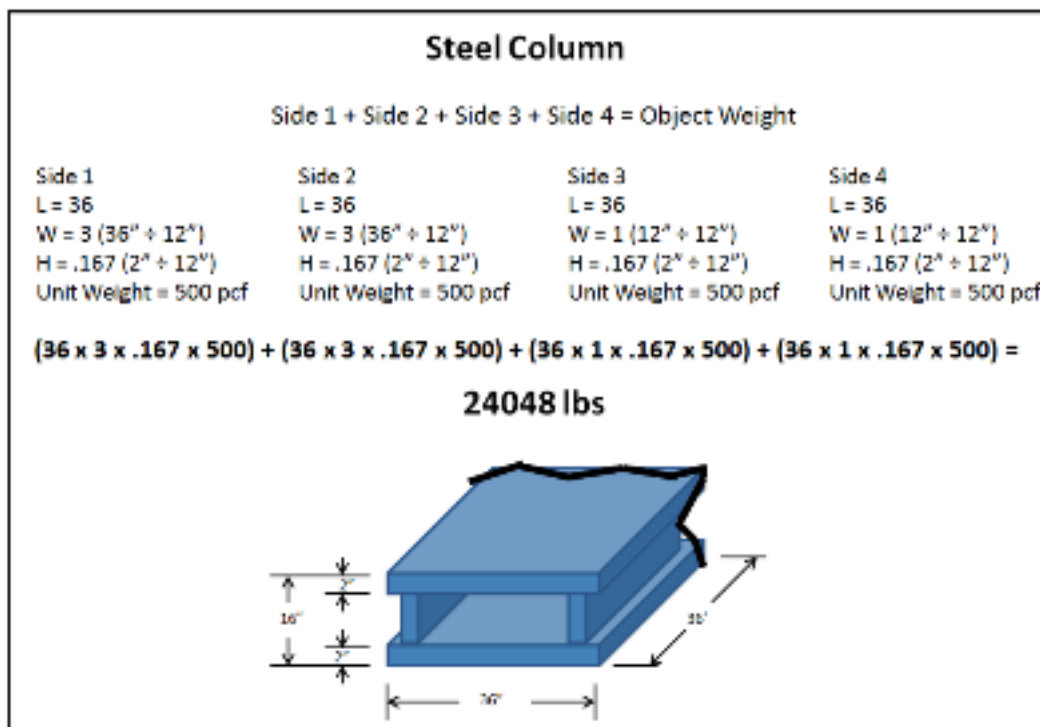**3.14 x .0625² x 20 x 500 pcf = 122.656 lbs**

Round Steel Bar
Figure 052-247-2106-7

7. Calculate the weight of a steel column.

   Note: Side 1 Weight + Side 2 Weight + Side 3 Weight + Side 4 Weight = Object Weight

Length x Width x Height x Unit Weight (from Figure 1) = Side Weight

Steel Column

Side 1 + Side 2 + Side 3 + Side 4 = Object Weight

Side 1	Side 2	Side 3	Side 4
L = 36	L = 36	L = 36	L = 36
W = 3 (36" ÷ 12")	W = 3 (36" ÷ 12")	W = 1 (12" ÷ 12")	W = 1 (12" ÷ 12")
H = .167 (2" ÷ 12")	H = .167 (2" ÷ 12")	H = .167 (2" ÷ 12")	H = .167 (2" ÷ 12")
Unit Weight = 500 pcf	Unit Weight = 500 pcf	Unit Weight = 500 pcf	Unit Weight = 500 pcf

(36 x 3 x .167 x 500) + (36 x 3 x .167 x 500) + (36 x 1 x .167 x 500) + (36 x 1 x .167 x 500) =

24048 lbs

Steel Column
Figure 052-247-2106-8

(Asterisks indicates a leader performance step.)

Evaluation Guidance: Score the Soldier a GO if all measures are passed (P). Score the Soldier NO-GO if any measure is failed (F). If the Soldier fails any measure show them how to do it correctly.

Evaluation Preparation: Provide the Soldier with all the items listed in the conditions.

Brief Soldier: Tell the Soldier to calculate the weight of rubble for a structural collapse.

PERFORMANCE MEASURES	GO	NO-GO	N/A
1. Calculated the weight of a square or retangular concrete object.			
2. Calculated the weight of a square or retangular concrete object with a hole.			
3. Calculated the weight of a solid concrete cylinder.			
4. Calculated the weight of a round hollow concrete pipe.			
5. Calculated the weight of a steel plate.			
6. Calculated the weight of a round steel bar.			
7. Calculated the weight of a steel column.			

Supporting Reference(s):

Step Number	Reference ID	Reference Name	Required	Primary
	Corps of Engineers	US Army Corps of Engineers, Urban Search and Rescue, Shoring Operations Guide, 3rd Edition	Yes	Yes
	NFPA 1006	Standard for Rescue Technician Professional Qualifications	No	No

Environment: Environmental protection is not just the law but the right thing to do. It is a continual process and starts with deliberate planning. Always be alert to ways to protect our environment during training and missions. In doing so, you will contribute to the sustainment of our training resources while protecting people and the environment from harmful effects. Refer to FM 3-34.5 Environmental Considerations and GTA 05-08-002 ENVIRONMENTAL-RELATED RISK ASSESSMENT.

Safety: In a training environment, leaders must perform a risk assessment in accordance with ATP 5-19, Risk Management. Leaders will complete the current Deliberate Risk Assessment Worksheet in accordance with the TRADOC Safety Officer during the planning and completion of each task and sub-task by assessing mission, enemy, terrain and weather, troops and support available-time available and civil considerations, (METT-TC). Note: During MOPP training, leaders must ensure personnel are monitored for potential heat injury. Local policies and procedures must be followed during times of increased heat category in order to avoid heat related injury. Consider the MOPP work/rest cycles and water replacement guidelines IAW FM 3-11.4, Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical (NBC) Protection, FM 3-11.5, Multiservice Tactics, Techniques, and Procedures for Chemical, Biological, Radiological, and Nuclear Decontamination.

Prerequisite Individual Tasks : None

Supporting Individual Tasks : None

Supported Individual Tasks :

Task Number	Title	Proponent	Status
052-247-1227	Rig a Load for Rubble Removal	052 - Engineer (Individual)	Analysis
052-247-1320	Construct Shoring Systems for a Light Frame Structure	052 - Engineer (Individual)	Analysis
052-247-1226	Conduct Lifting Operations for a Structural Collapse	052 - Engineer (Individual)	Reviewed
052-247-1325	Move a Heavy Load Within a Structural Collapse	052 - Engineer (Individual)	Analysis

Supported Collective Tasks : None